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pathological conditions, regardless of theories, whether they come to us with names hoary with age and ludicrous from their novelty. Day by day the veil of ignorance, superstition and intolerance is being lifted, and the time is near at hand when independent thought and correct reasoning must and will bear sway. Then the practice of medicine will stand upon merit and her own worth. She demands this and nothing more.

Ottawa.

The Early History of Pharmaceutical and Medical Chemistry.

L. E. SAYRE.

If any one is inclined to boast of his ancestry, we are told he will be relieved of his self-esteem if he goes back a few generations, when he is sure to find a jail-bird or some sort of a criminal. Pharmacy and medicine alike, by such a process, will be obliged to be somewhat modest, at least if they look up their past history. One need not go back farther than the sixteenth century—the period of medical mysticism, the iatro-chemical period—to discover one of our forefathers, Paracelsus by current name. His real name, however, was Phillipus Aurelolus Paracelsus Theophrastus Bombastus von Hohenheim. He was certainly a "bird" if not a jail-bird. One writer says of him: "He lived like a pig, looked like a drover, found his greatest enjoyment in the company of the most dissolute and lowest rabble, and throughout his glorious life was generally drunk." It is true that his life offered a strong contrast to his mentality, but he was a man of noble character and intentions, an ambulatory theosophist, who hoped to inspire mankind with a love of conscientiousness and veracity and to restore the suffering to health. He, bad as he was, liberated chemistry from the yoke of alchemy and joined it with medicine. He was an iatro-chemist, which, being translated from the Greek, signifies physician-chemist. He accomplished this during a period of ecclesiastical and national reformation, when Luther and Calvin were combating against superstition, and the changes he wrought, through his originality of thought and teaching, and freedom and vigor of expression, well entitle him to the appellation some have seen fit to give him, the "Luther of Medicine." So desirous was he of penetrating into the mysteries of nature, however, that he neglected books and took prolonged journeys through most of the known countries of the world (probably distances of about that from Kansas City to Chicago, or less). He sought to glean every scrap of knowledge obtainable from literary and learned men, mechanics, metallurgical workers, occults, and every one with whom he came in contact. He returned to Switzerland about 1525, and was recommended to the chair of physic at Basel. His self-confidence appears at this institution by publicly burning the works of Avicenna and Galen. He at once began his fight against the old medical school. He was forced to leave Basel in 1527, after a quarrel with the municipal council, and withdrew into Alsace, whither his fame in medicine followed him.

Paracelsus taught that "the object of chemistry is not to make gold, but to prepare medicines." He considered that the operations which occur in the human body are chemical ones and that the state of health is dependent upon the composition of the organs and the juices they secrete. Medicine, he asserted, rests upon four pillars, chemistry, philosophy, astronomy, and virtue. Organic (?) bodies were composed of mercury, sulphur and salt, which corresponded to the physical "phenomena of volatilization, combustibility and solidification," but which were related in a higher sense to spirit, soul and body; and the increase and decrease of these principles from their normal amount caused illnesses.

One of the disciples of Paracelsus, Johann Baptist von Helmont, was apparently modest. He says: "I thought it more profitable, seriously and conscientiously, to examine myself; and then I perceived that in reality I knew nothing, or, at least, nothing that was worth knowing. Finding that nothing was sound, nothing true, and unwilling to be declared master of the seven arts, my conscience told me I knew not one. The Jesuits, who then taught philosophy at Louvain, expounded to me the disquisitions and secrets of magic, but these were empty and unprofitable conceits; and instead of grain, I reaped stubble. In moral philosophy, when I expected to grasp the quintessence of truth, the empty and swollen bubble snapped in my hands. I then turned my thoughts to medicine, and having seriously read Galen and Hippocrates, noted all that seemed certain and incontrovertible; but was dismayed upon revising my notes, when I found that the pains I had bestowed, and the years I had spent, were altogether fruitless; but I learned at least the emptiness of books and formal discourses and promises of the schools. I went abroad and there I found the same sluggishness in study, the same blind obedience to the doctrines of their forefathers, the same deep-rooted ignorance." He therefore concluded that medical knowledge was not to be obtained from the writings of men or from human industry.

One of his discoveries was that dirty linen packed in a vessel with flour would in time produce mice, and that a toad's bones applied to an offending part was a certain anodyne. He boasted that he possessed a fluid, the "alcahest," which was capable of penetrating into bodies, producing an entire separation and transmutation of their component parts. No one, not even his son, saw this wonderful fluid, and its possession was a secret von Helmont cautiously guarded.

Von Helmont looked upon water as the chief constituent of all matter, and brought forward many arguments in support of his theory from the animal and vegetable world. That water was present in organic bodies he concluded from the fact of invariably procuring it as a product of their combustion. He believed that he contributed a strong proof of this by the following experiment: He took an earthen vessel of large dimensions, and filled it with two hundred pounds of dry earth, in which he planted a willow weighing five pounds. This was then duly watered with rain and distilled water for five years, at the end of which time he pulled up the willow and found that it weighed one hundred and sixty-nine pounds and three ounces. Moreover, the earth had decreased two ounces in weight. He therefore concluded that one hundred and sixty-four pounds of root, leaves, etc., had been produced from water alone, and that it was the only nutriment of plants. Fish, he asserted, live on water, and nevertheless, they contain all the peculiar animal substances; the latter are therefore produced from water. Basing his belief on such imaginary proofs as these, von Helmont was convinced of the transformation of water into earthy matter. With respect to his views concerning the four Aristotelian elements, he denied altogether that fire could be of material nature, but it is uncertain whether he regarded air as an element or not. His conception of the elements also differed from those of Basil Valentine and Paracelsus, for mercury, sulphur and salt were not to be detected in the human body.

The iatro-chemical doctrines contributed much to the general advancement of the science of chemistry, but two mistakes were made by the iatro-chemists; they endeavored to explain, on chemical principles, all the changes and processes occurring in the body, an attempt which was futile for the chemistry of that day; and, secondly, they set too narrow a limit for chemistry, which was not destined to remain in a subordinate position. Consequently, their medico-chemical ideas were upset after the middle of the seventeenth century.

Medicine developed very gradually until the time of Galen, who developed the use of vegetable drugs and herbs in pharmacies where at that time medicine was practiced with the administration of such vegetable potions and herbs as were then used.

One of the ancient pharmacists of the fourth century describes a "water of the gods" as Panacee (from Pan and aqua) as a cure-all, and from this is derived our word panacea.

Then in the sixteenth century we pass to the school of medical alchemists, the most famous of whom was Paracelsus. This school was called the iatro-chemical school and its theory announced by Paracelsus was that the healthy body, being made up of certain chemical substances in solution, could, when diseased, be cured only by the same chemical substances; hence he preached that Galen's theory of herbs and vegetable drugs curing the diseased body was erroneous. He hence dosed heavily with mercury salts, blue vitriol, sugar of lead, antimony salts, sulphuric acid, iron salts. While he, and especially many of his pupils, killed many people and were driven out of town after town, his theory gave the next great impetus to pharmacy and, incidentally as well, founded chemistry, for the great problem now became to invent and discover new chemical compounds for the relief of disease, and this was done in the shops of the alchemist-pharmacist. His successors, Sylvius, Tachenius, Von Helmont, Agricola, Glauber, Libavius and Pallissy, in consequence developed a great number of such metallic compounds as well as some organic compounds. Here we hence see that in the early history of all three sciences—medicine, pharmacy and chemistry—all three were practically united in one, and frequently practiced by one person, who, however, almost invariably received his training in a medical school and bore the title doctor. The alchemist's shop was the pharmacy and the owner of it practiced the healing art as well as the preparation and compounding of his medicines. From these shops developed, through the zest for discovering new medicines, the chemist and the science of chemistry.

Later came the separation of all three during the eighteenth and nineteenth centuries, and gradually the chemist became the scientific student looking for scientific laws governing the composition of matter and the changes it undergoes; the medical men became the curers of disease and the student of the human body in health and disease, while the pharmacist became the student of the plants of the field and forest, the chemicals of the chemist, and their proper preparation in forms suitable for administration as medicines. Each had his field, and each field was important and required great patience, ingenuity and careful study and observation. Each science developed gradually and steadily along different lines, medicine and pharmacy confining their activities to curing disease, while chemistry not only did its share to produce new medical substances, but spread out gradually over all the other branches of industry that have to do with matter of any and every kind, until to-day any industry that does not employ the latest discoveries and methods of chemistry in its processes, from the laundry to the steel plant, cannot successfully compete with its present-day competition.

Such were the remote beginnings of pharmaceutical and medical chemistry. We may imagine one of our remote ancestors brought face to face with disease. How mysterious must have seemed to him the phenomenon that to-day he is strong, active and full of life and to-morrow he is weak, listless and about to die. How earnestly he must have sought for means to remedy it. Spiritual and material means appealed to his untutored mind. The modern savage shows the relics of this dual method of combating disease. On the material side he found, in his search for remedies, activity in bitterness and bitter substances, which he came to regard by experimental method as beneficial. Harry Frank, in his recent fascinating work, "Vagabonding Down the Andes," gives the following interesting story which is apropos. He is describing Loja, which was once the center of commerce in South America in cascarilla (cinchona):

> Loja was once the center of the commerce in cascarilla. The bark of a tree not unlike the cherry in appearance abounds in the ravines of the mountains to the eastward of the city. Nearly three centuries ago a missionary through the region found the Indians grinding the bitter bark in their stone mortars and swallowing it as a specific against intermittent fevers, as they do to this day. When the wife of Conde de Chinchon, viceroy of Peru, lay ill of the fever in Lima the corregidor of Loja sent to her physician a parcel of the powdered bark. Upon her return to Europe the Condesa carried a quantity of the magic powder with her, whence it was for a long time known as cinchona. Meantime, Jesuit missionaries of Brazil had sent parcels of it to Rome, whence it was distributed among the brotherhood, nothing loath to add to their reputation for miraculous powers and to the income of their drug store, and the name of "Jesuit bark" became widespread. The tree, however, has always been known to the Indians by the name Quina-Quina, and in time the refined product, quinine, took on its modern name.

From ancient times to later periods a mass of bitter and nauseous substances were found and stored in the medical armory, used in the battle against disease. Now the time was ripe for the pharmaceutical chemist who devoted his energies to the problem of active principles (such as alkaloids, glucosides, resins, etc.) from these simple bitter substances, thus finding out their chemical composition and the relation these had as antagonists to disease. We have then, as a result, the principles well known as quinine, morphine, atropine, aconitine, strychnine, digitalline, cocaine, codein and a host of others, and these have been (with coöperative work with physicians) *classified* with reference to their disease antagonistic properties. So that now we are entering upon the domain of *rational* therapeutics, and pharmaceutical chemistry has come to its own as a distinct science, while medical practice has all it can do to attend to its specialized field, which, like pharmacy, is rapidly becoming divided into groups of specialists that promises for the future greater and greater efficiency.

University of Kansas, Lawrence.

The Progress of Science Since the Foundation of the Kansas Academy of Science.

SAMUEL W. WILLISTON.

It was fifty years ago last autumn that, as a lad, I came under the instruction of the late Prof. B. F. Mudge of the Kansas Agricultural College. Bred as a lawyer in Linn, Mass., his early love for science led him into the study of chemistry, mineralogy and geology. Serving for a while as chemist in an oil refinery in Kentucky, his staunch New England training sent him, like so many others in those days, to Kansas, the border land of freedom, where, after a brief service as state geologist, he was made professor in the new Agricultural College.

It was his lectures on geology in Manhattan that inspired in me, a boy—inspired is the right word—the love for science that has lasted throughout my life. For ten years I was more or less under his guidance and influence, in the school room and in the field. My debt to him has never been, can never be repaid. He taught me all of science that was then taught in highest institution of learning in Kansas—natural philosophy as it was then called, chemistry, geology, botany, mineralogy, zoölogy, veterinary science, surveying and mathematics; and for a while even he was my instructor in Latin. A beloved teacher, a noble and upright man, he loved science for science's sake, without regard for personal emolument. He was the real founder of this Academy; nay more, the founder of science in the young state of Kansas, and as such his name will never be forgotten in its annals.

I recall vividly the beginnings of this Academy and the part that he took in its foundation. I wonder if there are others who do? And I recall the talk he gave his pupils about it and what he hoped for its future. I would that I could tell him how grandly his hopes have been fulfilled. The Academy has had an honorable past; may its future still be as bright as he foresaw.